

Abstract

A density/solute monitor having at least one ultrasound probe, a signal processing unit, and a computing mechanism, and process for using the same, to measure phase shift between emitting and receiving ultrasound, sound velocity, compressibility, density, and solute concentration of fluid flowing through a fluid processing system. The ultrasound probe emits and receives ultrasound waves through the fluid and the signal-processing unit and computing mechanism process the ultrasound waves to determine phase and time shift. The computing mechanism converts phase shift to density, compressibility, and solute concentration measurements of the fluid. Calibrating fluids calibrate the detected phase shift in terms of sound velocity in the factory. Measurements provide information about passage of solutes and flow to achieve better solute collection efficiency, solution purity, and control of fluid processing systems. The density/solute monitor can include other detection modalities such as an optical probe, making concentration measurements of the density/solute monitor more specific to selected solutes.